Challenges for algorithmic execution

Gordon Baker

Agenda

- Context
- Research
- To do

Some definitions

Execution vs. trading

- Execution
  - No choice of asset, direction or quantity
  - Usually intra-day or good for day orders
- Trading … everything else
  - Market making
  - Arbitrage
  - Model based trading

A brief history

1980s

Technique

- VWAP, TWAP and participation strategies
- Empirical approaches to market impact

Significance

- Market structure (electronic order books) determines spread of automated strategies

A brief history

1990s

Technique

- Bertsimas & Lo 1998
- Further gaming countermeasures

Significance

- ITG is first algorithmic brokerage
- 1997-2000 day trading: everyone became a model driven trader

A brief history
2000s

Techniques

- Landmark research
  - Almgren & Chriss 2000
  - Almgren 2001
  - Kissell, Glantz & Malamut 2003
  - Kissell & Malamut 2005
- Arrival price strategies
- Portfolio strategies

Significance

- Credit Suisse launches AES in 2000
- DMA and algorithmic execution account for 50% of NYSE turnover
- Some broker-dealers have 80% of order flow executed by algorithmic strategies

Algorithmic execution strategies

A broad classification

Completing

- Quantities
  - VWAP
  - TWAP
- Participation rates
  - Arrival price or shortfall

Non-completing

- Participation
- Relative value

Where we are now

"Algorithms are only good for liquid stocks"

Broker-dealers

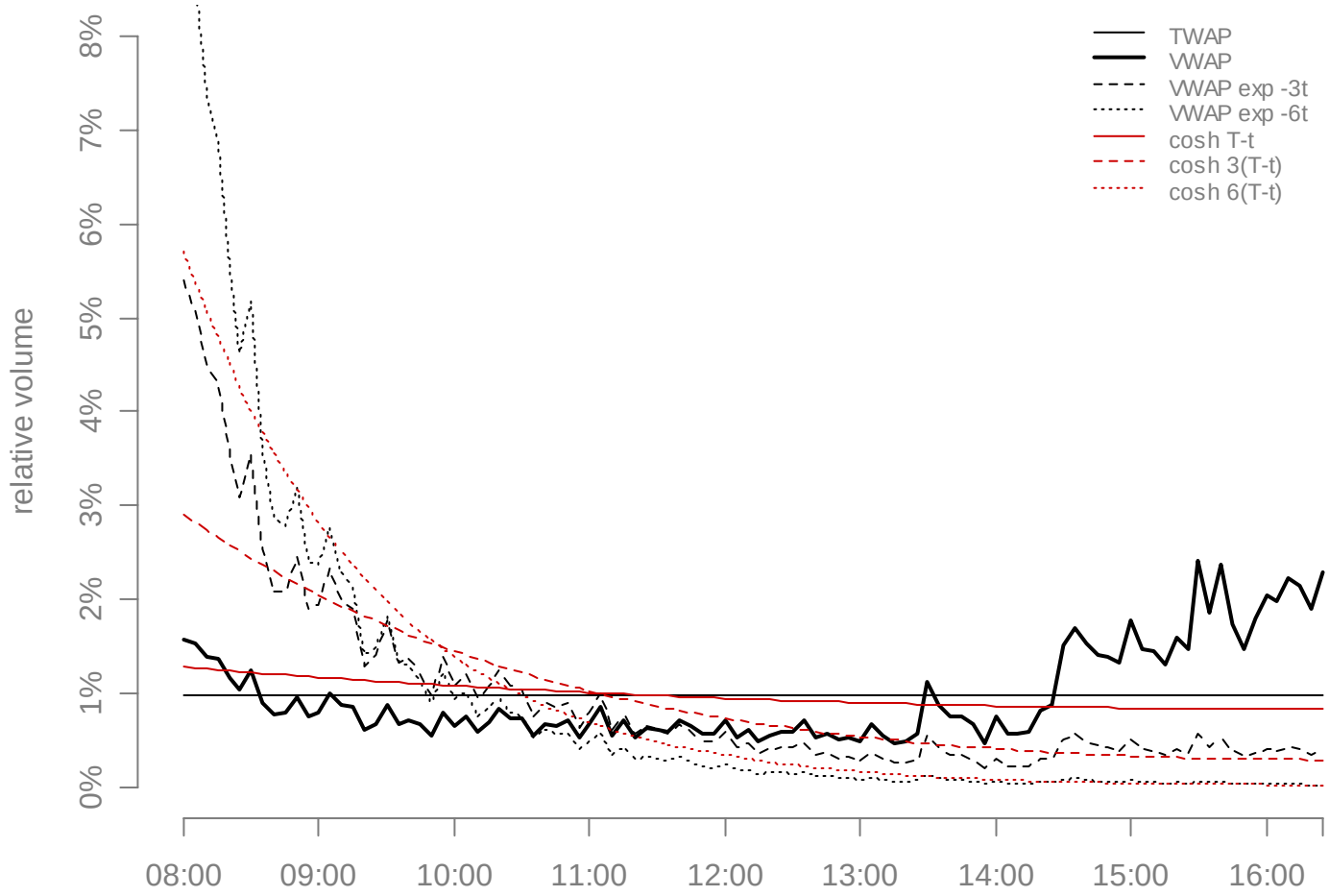
- Widespread use of algorithmic execution, either directly or when unwinding
- Brand explosion of strategies

Investors

- Broker-dealers algorithms used for 15-30% of orders
- Increasing addition of constraints to orders
- Consequence: completing strategies become non-completing

Execution schedules

Research has provided the benchmarks



Execution models

Strengths

- Mathematically sound approaches to optimising variance
- Common ground for investors and broker-dealers

Weaknesses

- Assume perfect markets
- Do not address tactics or order placement decisions

Other academic contributions

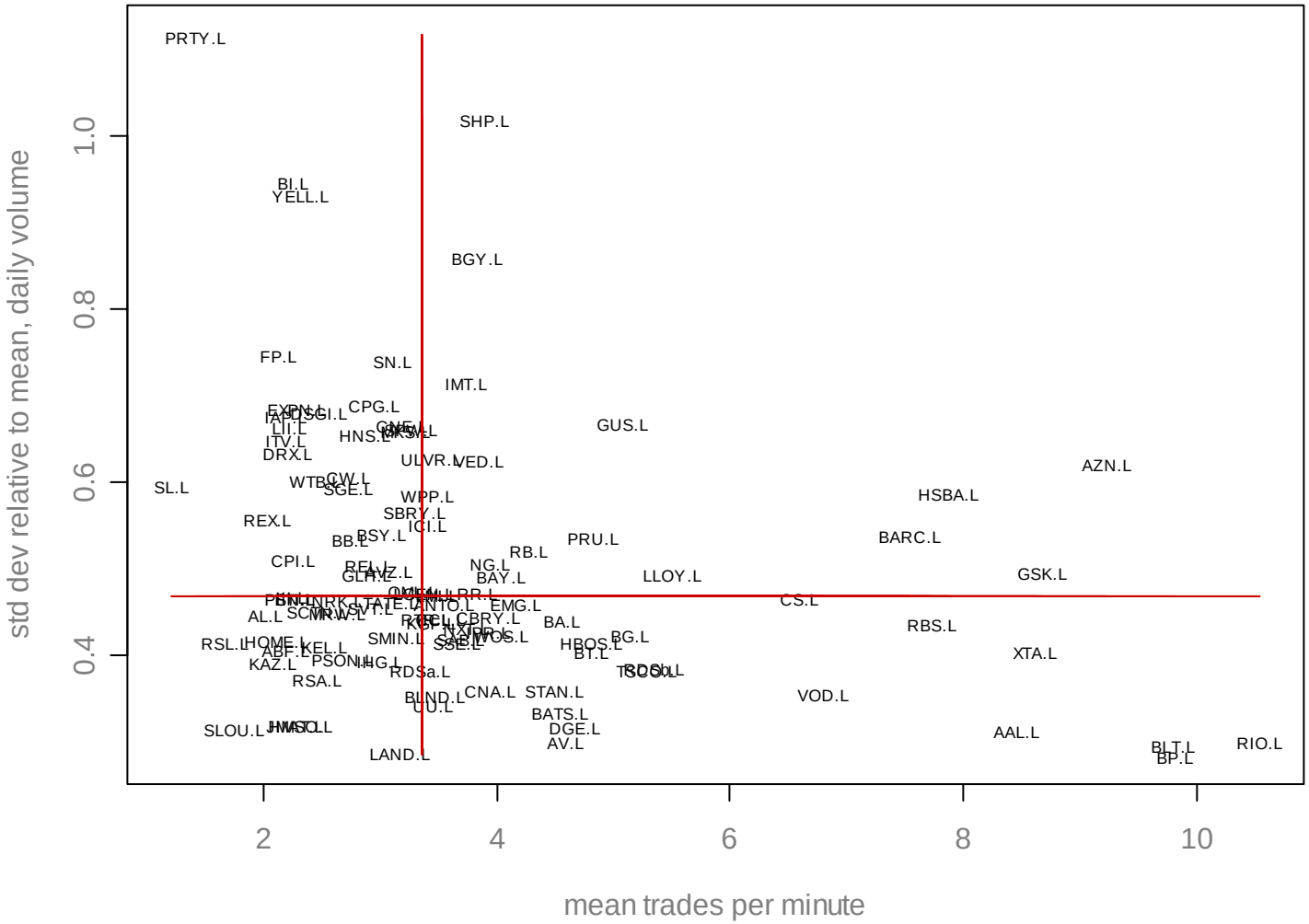
- Econophysics
  - Models for non-gaussian returns
  - Minority games
- Behavioural finance

Challenge #1

VOLUME

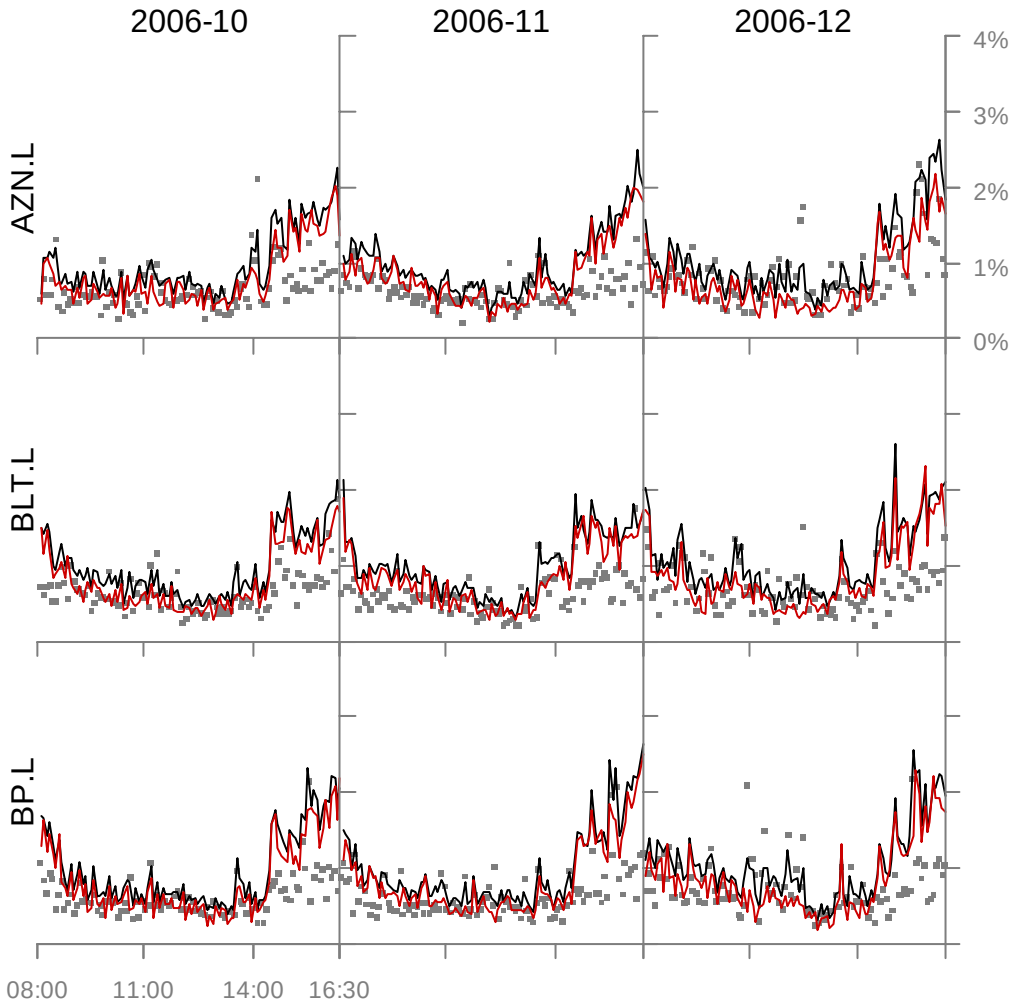
The extremes for algorithmic execution

Volume and trade frequency within the FT-SE 100



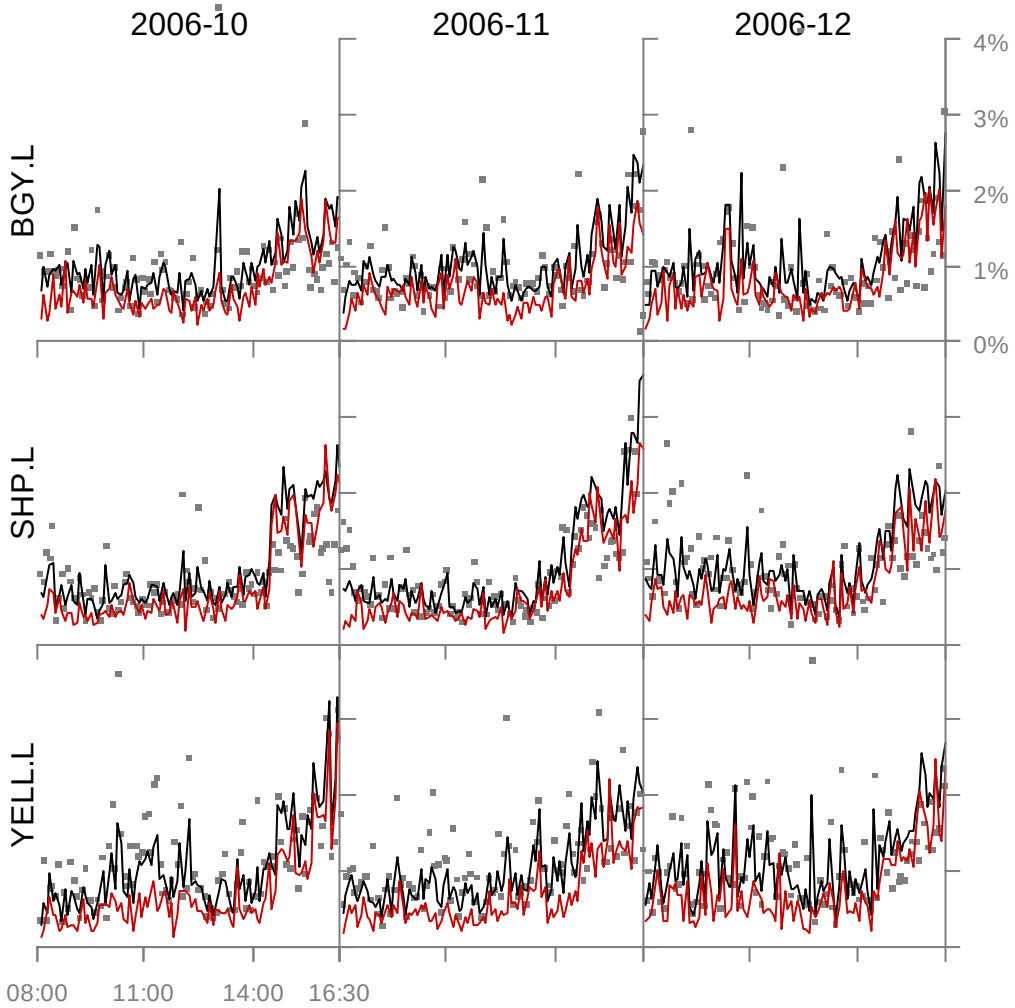
The well behaved …

High trading frequency – low volume variance



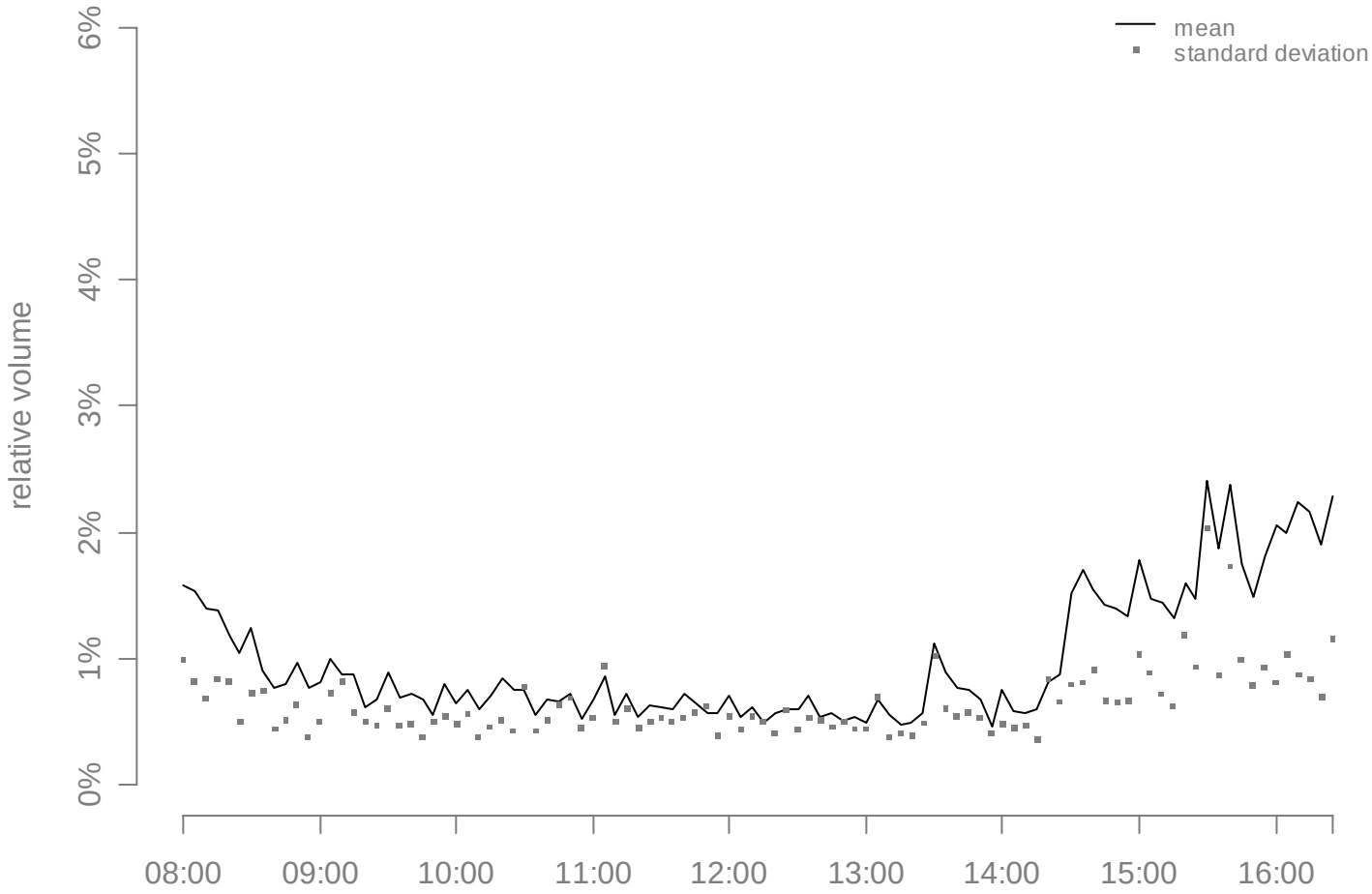
… and the not so well behaved

Low trading frequency – high volume variance



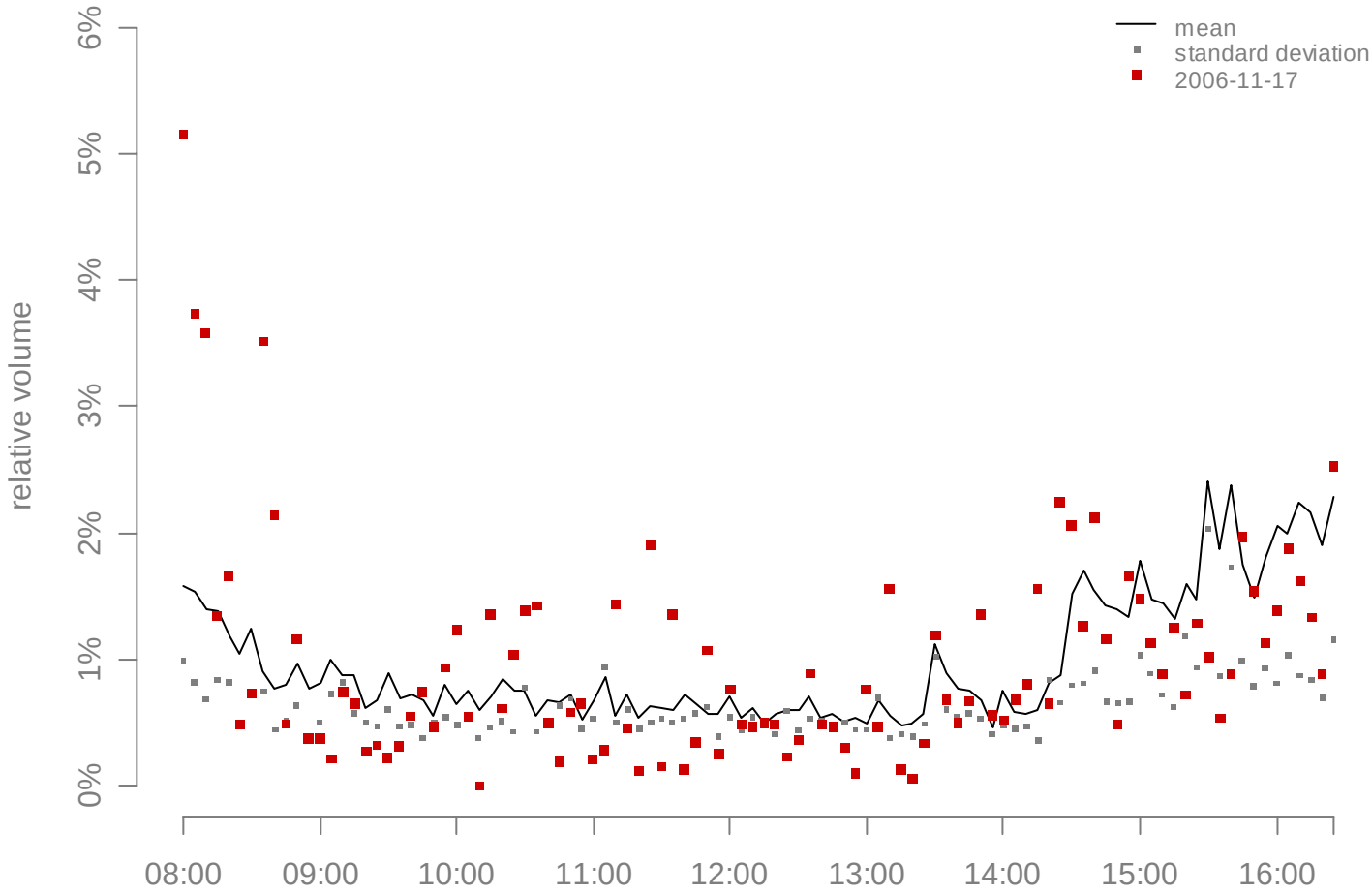
Even the more liquid …

BP.L until mid November 2006



… can surprise

BP.L traded twice its mean daily volume on November 17



Coping

Towards a common understanding of behaviour

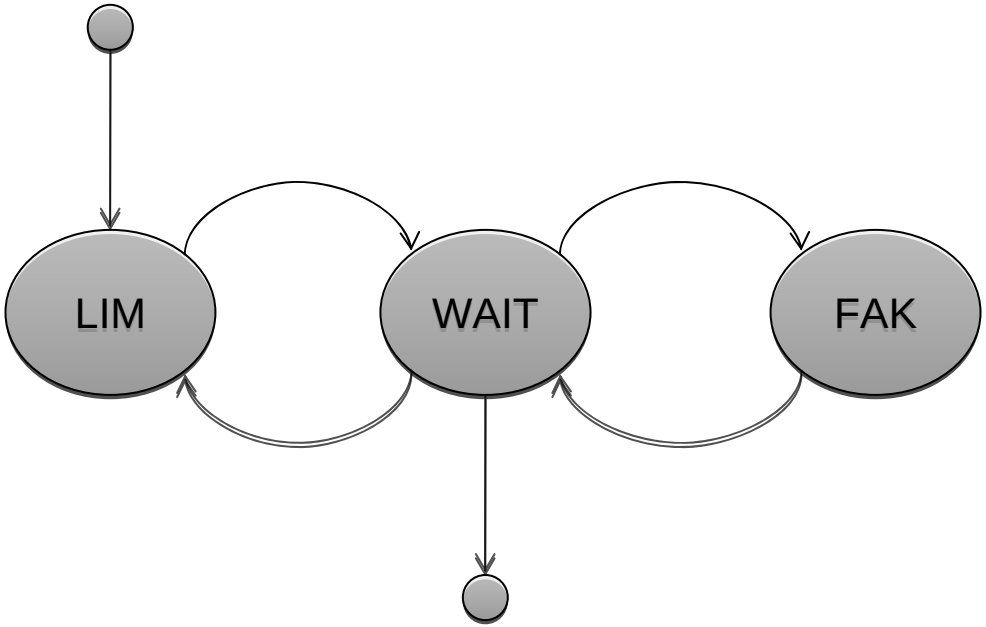
- Median curves?
- Volatile daily volume has no effect for completing strategies constrained by time
- Prediction of relative weighting?

Challenge #2

EXECUTION MICRO-ECONOMICS

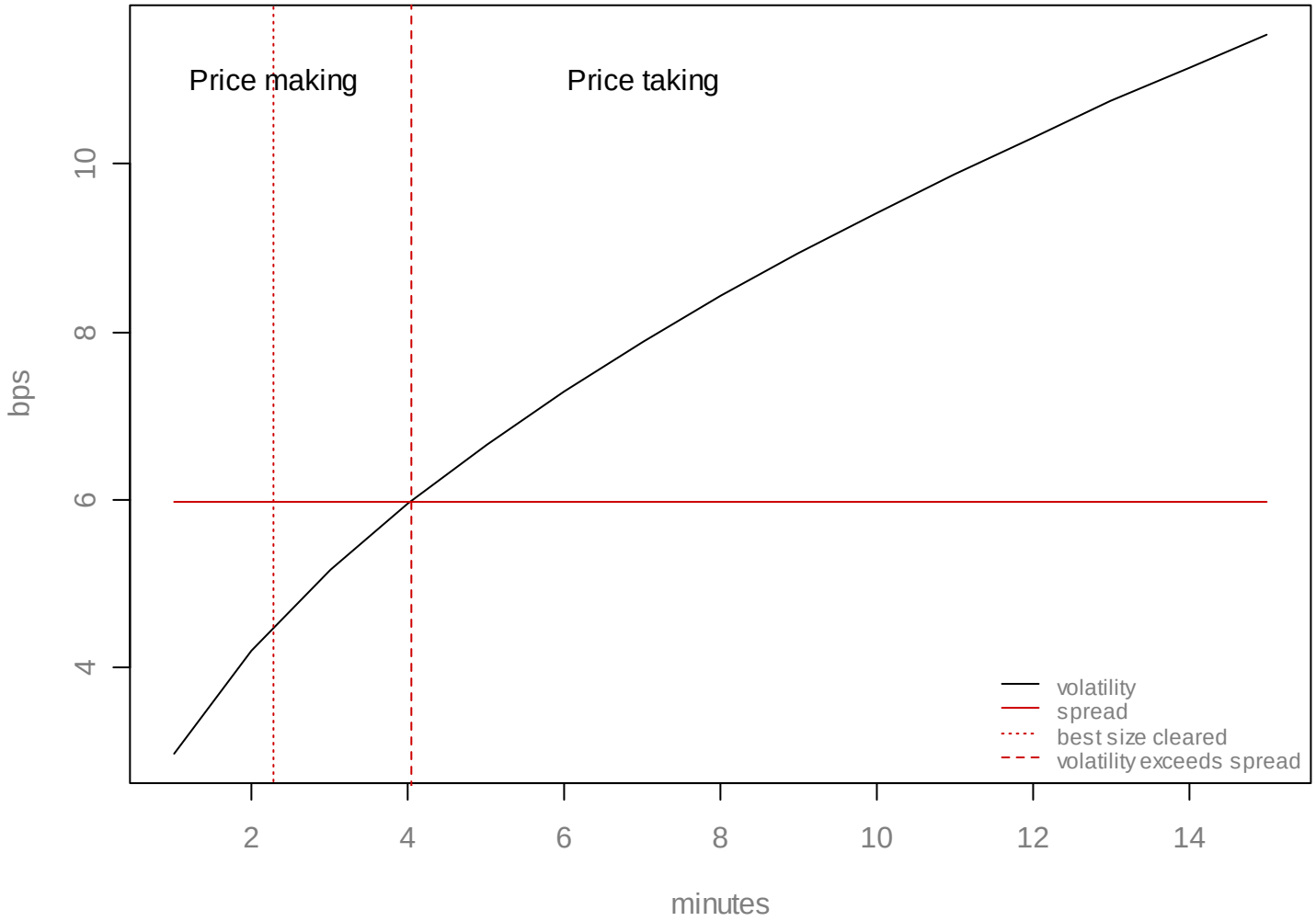
Order submission

The fundamental state model is simple



Order submission

Some of the microeconomics



SUMMARY

Algorithmic execution

- One of the major execution methods
- Contribution from research is clear
- More is needed to keep the mutual expectations of buy- and sell-side in line
- Two challenges today
  - Turning attention on the volume dimension
  - Formalising the different levels of execution model

Algorithmic execution

Data provided by

Analysis tools

Further information

http://www.gbkr.com